that the tallest men are found in the less sunny climates; the advantages of cloudy weather in increasing the vital activities; the value of dark forests as sanitaria; the dangers of too much light in the treatment of tuberculosis, etc. Many of Major Woodruff's ideas are certainly contrary to generally accepted notions regarding the importance of sunlight. He advocates playgrounds for city children, but adds, "let the parks be well shaded, and not the stunting sand baths which are so harmful." In closing his notes, Major Woodruff laments the fact that climatologists have been so slow to take up the study of light, and calls attention to the well-known lack of careful and systematic observations of the intensity of sunlight. It is well that medical men should spur on climatologists to take more and better observations along many lines, and Major Woodruff's interesting views, and his enthusiastic advocacy of them, will serve a useful purpose if they lead to further investigation by meteorologists and climatologists along actinometric lines.

FRESH WATER IN A WATERSPOUT

WATERSPOUTS—perhaps often better called cloud-spouts—seem to draw up water from the surface over which they occur, and it is, therefore, not infrequently believed that they are largely composed of salt water in cases where they are seen over the oceans. There is an old story of a vessel which passed through a waterspout (quoted in Davis's "Elementary Meteorology," page 283). The captain was drenched in a downpour of water, which nearly washed him overboard. On being asked whether he had tasted the water he replied: "Taste it. I could not help tasting it. It ran into my mouth, nose, eyes and ears." "Was it then fresh or salt?" he was asked. "As fresh," said the captain, "as ever I tasted spring water in my life." In *Symons's Meteorological Magazine* for April, 1907, there is an account of waterspouts which were encountered by the British steamship *Dalyarth* in the Euxine, July 15, 1906. The steamer passed within one half mile of the spouts. "There was a sound of broken water, resembling distant surf on a beach; a terrific deluge of rain, which obscured all view of the waterspout—even the lightning failed to penetrate through the downpouring sheets of water. The falling water was fresh." Dead fish were later seen lying on the surface of the water, and some even fell on the decks of the steamship.

DUST WHIRL AT JOHANNESBURG

PHOTOGRAPHS of dust whirls are not abundant, and those who are interested in such matters may be glad to note the publication of two views of a dust whirl in the "Report of the Director of the Transvaal Meteorological Department for the year ending June 30, 1906" (Pretoria, 1907). October 21 was calm and hot at Johannesburg, the conditions being favorable for the production of dust whirls. Several large ones were seen during the day. One of them, which passed over the suburbs, did some damage. The two views show different stages of the same whirl.

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CURRENT NOTES ON LAND FORMS

EARTHQUAKE FISSURES AND SCARPS

A SUMMARIZED description of fissures and scarps due to earthquakes is presented by W. H. Hobbs in his essay "On Some Principles of Seismic Geology" (*Beitr. zur Geophysik*, VIII., 1907, 219–292), under the title "Dislocations at the Earth's Surface as the Result of Macroseisms" (pp. 236–253). Thirty-one examples are cited. Some of the most important are as follows: In India at the head of the Arabian Sea, 1819, the scarp "rose like a wall above the plain, 16 miles in length," with a vertical displacement of 20 feet; near Wellington, New Zealand, 1855, a cleft was formed for 90 miles with a displacement of 9 feet; in Tulare County, California, 1856, a fissure "in a uniform direction for a distance of 200 miles"; at Fort Tejon, California, 1857, a fissure 20 feet wide and 40 miles long; in Owens Valley, California, 1872, a scarp was formed 40 miles long and from 5 to 20 feet in height; in the Tarawera district, New Zea-

land, 1886, the main cleft was about 6 miles long, nearly straight; in the Sonora district of Arizona and Mexico, 1887, an irregular fissure, 35 miles long, with a displacement from 8 to over 20 feet; in the Neo valley, Japan, the Mino-Owari earthquake of 1891 produced a scarp for 40 miles, with a displacement of more than 10 meters; northwestern India, 1892, a fissure 120 miles in length; and finally the long fissure of the San Francisco earthquake of 1906. In several cases, the new fissures followed lines of depression or subdued scarps, presumably formed by earlier earthquakes.

It would be of interest, in comparing these seismic features with the straight lines representing "lineaments" which Hobbs in this and other papers draws through points where earthquakes have been recorded and along lines of coasts or valleys, to inquire carefully into the course followed by observed fissures and scarps, in order to determine how far they would give warrant for the rectilinear course of hypothetical lineaments (rectilinear, at least, on the maps employed). As far as data are at hand, it does not appear that observed fissures and scarps are straight enough to give support to Hobbs's lines, which in any case seem, as far as earthquakes are concerned, to be largely influenced in location and direction by the evidently subjective element of the location of cities and villages where observers are numerous. For example, in the absence of evidence as to recent or ancient fault lines, the fact that earthquakes have been recorded at Springfield, Hartford and New Haven is no sufficient reason for thinking that seismotectonic information can be gained by drawing a straight line across Connecticut into Massachusetts through these three cities (see Fig. 7, p. 268); indeed, there is even less reason for thinking that seismotectonic lines should be closely related to centers of urban population than that rivers should run by large cities.

FAULT SCARPS AND FAULT-LINE SCARPS

THE relation of earthquake scarps to modern and to ancient faults is to-day well proved. The San Francisco earthquake fracture followed, for at least part of its length, a previously known fault line of thousands of feet displacement, along which the signs of geologically recent movement were so manifest that those familiar with the ground had for some years expected the occurrence of further disturbance. The long fault line at the base of the Wasatch range in Utah, with its recent scarps across alluvial fans and flood plains, is well known through Gilbert's reports. These and other geologically modern fault lines are all more or less curved or irregular. Many other faults are so ancient that the faulted mass may have been baseleveled and afterwards broadly uplifted (without renewed displacement) so as to suffer revived erosion, whereby the weaker rocks, whether in the heaved or in the thrown block, have been worn away; thus fault-line scarps, as they may be called, are produced. Such a scarp differs from a fault scarp in various significant respects. A *fault scarp* is a direct measure of differential displacement, except in so far as it is defaced and dissected by erosion; its altitude equals the vertical displacement of the fault; its length equals the length of the fault; it always faces from the heaved to the thrown block. A *fault-line scarp* in its most characteristic development—namely, where the original displacement has been baseleveled in a completed cycle of erosion, and where the succeeding cycle has reached early maturity—faces the side of the weaker rocks; its altitude has practically no relation to the original displacement, but depends on the amount of elevation by which the new cycle is introduced, or on the thickness of the body of weak rocks. The length of such a scarp is not a measure of the original fault length, but of the distance over which rocks of unlike resistance happened to be brought next to each other by the faulting. When a fault-line scarp faces the heaved block it may be described as a topographically reversed fault-line scarp; but care must be taken not to confound it with a "reversed fault" of geological nomenclature. When the rocks on the two sides of a baseleveled fault are of the same hard-

ness, then revived erosion may produce, in the early youth of the new cycle, a fault-line valley; the work of a consequent or of a subsequent stream, as the case may be.

This problem is only a special phase of the general treatment of faults from the physiographic instead of from the geologic point of view. For the geologist, once a fault, always a fault; displacement, length, heaved block, thrown block, etc., retain their values and their names indefinitely. For the physiographer, once a fault scarp, afterwards something else: the scarp retreats from the fault line; inequality of level across the fault line ordinarily decreases and ultimately vanishes, but it may for a time be reversed even in the first cycle of erosion; if a completed cycle is followed by uplift, revived erosion may produce a narrow fault-line valley; or a fault-line scarp, the aspect, height and length of which have no definite relation to the aspect and dimensions of the original displacement. The effects of insufficient attention to the physiographic aspects of faulting are illustrated in the following note, as well as in a current discussion on "How should faults be named and classified" in the *Economic Geologist,* where consideration is given only the underground elements, as is natural enough in a geological discussion, though somewhat inappropriate to the general title under which the discussion has been carried on.

FAULT-LINE SCARPS IN SWEDEN

THE uplands of central Sweden possess a number of well-defined scarps, which are described by Gunnar Andersson as due to faulting, with only subordinate modification by erosion ("Om Mälaretrakternas geografi," *Ymer-tidskrift utgifven of Svenska sällskabet för antropologi och geografi,* 1903, 1–64). For reasons stated below, these features are better interpreted as fault-line scarps; but however they are regarded, they give no countenance whatever for drawing rectilinear structural lines or "lineaments" between points from which earthquake reports are received. It is true that many of the Swedish scarps have a rough east-west trend; but it would be quite impossible to determine the further extension of any one of them by continuing the trend of even the least curved part of its irregular course. These fault lines, along with many others, prove that the highly exceptional quality of a straight line is not to be expected in crustal dislocations.

Andersson infers a modern (Tertiary) date for the faults of central Sweden, because the scarps along the fault lines are still well defined; but in reaching this conclusion he has taken no account of the possibility of two cycles of erosion. He argues that, if the faults were ancient, their scarps would have been long ago planed down by erosion. On the other hand, it is manifest that even if the faults were of paleozoic date, the scarps might be distinct to-day if, after having been base-leveled, they were re-developed by the removal of weak rocks along one side of the fault line in a new cycle of erosion. That at least two cycles of erosion since the period of faulting must here be reckoned with is strongly indicated by the occurrence of numerous narrow fault-line valleys through districts of resistant crystalline rocks; the uplands on either side being of essentially equal height. An account of some striking examples of these narrow valleys is given by A. Larsson, "Topografiska studier i Stockholmstrakten," *Ymer,* 1906, 273–292. Near by, along parts of the same fault lines or of similar fault lines, well-defined scarps separate uplands of crystalline rocks from lowlands in which the crystallines are at least in some instances patched with small remnants of a former unconformable cover of relatively weak paleozoic strata. In these instances there is good reason for thinking that the now lower ground was, at the beginning of the present cycle of erosion, filled up to the level of the crystalline uplands with the paleozoic strata; and hence that while the erosion by which the fault-line scarps were developed may well be of Tertiary date, the date of the faults must be decidedly earlier.

The district here considered, lying not far west of Stockholm, will presumably be visited by excursions at the time of the next International Geological Congress in 1910. It is as

unique in its way as are the zigzag ridges of the Pennsylvania Alleghenies. Its development, on the more-than-one-cycle scheme, appears to have been as follows: The great body of complicated crystalline rocks was effectively baseleveled in ancient times, and covered unconformably with early paleozoic strata. The compound mass was afterwards broken by numerous faults, which divided it into many irregular, (nearly) vertical prisms; and the prisms were irregularly jostled and tilted. At that time the surface must have been characterized by many displaced blocks, topped with paleozoic strata and separated by fault scarps. Then the whole district was again baseleveled; this being indicated by the general accordance of upland heights to-day, irrespective of faults. On the peneplain thus produced, the paleozoic strata would remain only where they lay below baselevel. A broad upwarping introduced a new cycle, which has now advanced (glacial erosion included) so far as to have almost entirely consumed the previously inaccessible remnant-covers of paleozoic strata, thus developing fault-line scarps in good number; while the fault lines through the crystalline uplands are now marked by narrow fault-line valleys.

This case is similar in some respects to that of the Hurricane ledge in Arizona, next north of the Colorado canyon. When first described by Dutton (Monogr. II., U. S. Geol. Surv.), this strong escarpment was interpreted as marking a recent fault, and its height was taken as a measure of the fault. Reasons have since been given for believing that the fault is not recent (where the N-S fault line crosses certain erosional E-W escarpments, the corresponding members of the latter are out of line by several miles, and this departure from alignment must represent the excess of escarpment retreat in the heaved block over that in the thrown block); that the original displacement was essentially obliterated by baseleveling (a level, unbroken lava flow crosses the fault line at one point, passing evenly from strong to weak rocks); and that the existing scarp is a fault-line scarp produced by the action of revived erosion on the weaker strata along one side of the fault line.

W. M. D.

STAFF OF THE ROCKEFELLER INSTITUTE

THE Rockefeller Institute for Medical Research has adopted as titles for its staff member, associate member, associate, assistant, fellow and scholar of the Rockefeller Institute, and has made the following list of appointments:

Member of the Institute and Director of the Laboratories—Simon Flexner, pathology.

Member of the Institute—S. J. Meltzer, physiology and pharmacology; E. L. Opie, pathology; P. A. Levene, biological chemistry.

Assistants of the Institute—Hideyo Noguchi, pathology; John Auer, physiology; Alexis Carrel, experimental surgery; J. W. Jobling, pathology; Nellie E. Goldthwaite, chemistry.

Fellows of the Institute.—C. M. A. Stine, biological chemistry; Donald Van Slyke, biological chemistry; Martha Wollstein, pathology; Maud L. Menten, pathology; Mabel P. Fitzgerald, bacteriology; Don R. Joseph, physiology; Benjamin T. Terry, protozoology; Thomas W. Clarke, pathology.

Scholar of the Institute—Bertha I. Barker, pathology.

Grants to aid special researches have been made to the following: Robert M. Brown, New York; C. H. Bunting, Charlottesville, Va.; Katherine Collins, New York; Cyrus W. Field, New York; N. B. Foster, New York; Joel Goldthwaite, Boston; Holmes C. Jackson, Albany; Arthur I. Kendall, New York; Waldemar Koch, Chicago; W. G. MacCallum, Baltimore; Wilfred H. Manwaring, Bloomington, Ind.; J. W. D. Maury, New York; F. G. Novy, Ann Arbor; W. Ophüls, San Francisco; Richard M. Pearce, Albany; H. T. Ricketts, Chicago; Hermann W. Schulte, New York; Charles E. Simon, Baltimore; Aldred S. Warthin, Ann Arbor; Francis C. Wood, New York.

SCIENTIFIC NOTES AND NEWS

SIR JOSEPH D. HOOKER, who celebrated his ninetieth birthday on June 30, has been made a member of the Order of Merit.